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Authors

Federspiel, Clifford C
Villafana, Luis

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A Tenant Interface for Energy and Maintenance Systems

Clifford C. Federspiel

Center for the Built Environment
University of California
390 Wurster Hall, #1839
Berkeley, CA 94720-1839 USA
+1 510 643 1209
cliff_f@uclink.berkeley.edu

Luis Villafana

School of Information Management & Systems
University of California
102 South Hall
Berkeley, CA 94720 USA
luisv@sims.berkeley.edu

ABSTRACT

We describe the design of a user interface for energy and maintenance systems in commercial buildings. The user interface is for use by occupants (tenants) of commercial buildings. Our hypothesis is that by allowing tenants access to information from the energy and maintenance systems and by giving them some control over these systems, energy and maintenance performance can be improved. We used interviews with potential users and existing energy and maintenance databases to guide the design.

Keywords

User interface, energy management, maintenance, buildings

INTRODUCTION

Energy and maintenance systems in commercial buildings consist of digital control devices, a communications network, databases, applications for various functions, and a user interface. One of the most advanced energy and maintenance systems developed to date is GEMNet [1]. GEMNet is an integrated information technology infrastructure for energy and maintenance management. It uses a common database system for all components and an open communications protocol called BACNet [2].

GEMNet uses modern web-based technology for its user interface. However, the intended users of GEMNet only include maintenance personnel. The way that building occupants interact with GEMNet is by making a telephone call to someone in the maintenance department to request service or report a problem. The maintenance personnel manually enter the service request into GEMNet, sometimes long after the phone call has been made.

Our work on the interaction between building occupants and energy and maintenance systems [3,4] suggests that building occupants should also be considered users of energy and maintenance systems. Until recently this has been considered an unwise, even radical, idea among facility management professionals. However, providing tenants with a user interface to energy and maintenance

systems should improve thermal comfort, improve the performance of energy management strategies, eliminate some redundant service requests, and improve the quality of data in maintenance databases. A well-designed user interface should also improve the satisfaction of the occupants with the services provided to them by maintenance personnel.

In this paper we describe the design of a Tenant Interface for Energy and Maintenance Systems (TIEMS). TIEMS is designed to operate as a component of GEMNet. The next section covers the methods we used for design. The following section includes the results of our pre-design investigations, and a description of the design itself. We conclude with a section on expected benefits of TIEMS.

METHODS

We interviewed three tenants from three different agencies in a U.S. federal building. We asked questions designed to provide information about how the problem reporting process currently works, their satisfaction with the current process, their needs for changes, and whether or not they would be receptive to our proposed design ideas.

We held meetings with the building energy and maintenance staff to discuss our concepts for the design of the user interface. We described our previous research results, proposed our design for TIEMS, and asked for their feedback.

We used the results in [3,4] and current maintenance records to guide the design of TIEMS. These sources of information include maintenance records from hundreds of buildings covering a duration of several years in total

RESULTS

From the interviews with tenants, we learned the following:

1. All tenants currently report service requests by telephone. Office assistants usually report problems on behalf of others.
2. The average satisfaction level with the reporting process was 2 on a scale of 1 to 5 with 1 being the most satisfied and 5 the least satisfied.
3. All tenants complained about not being able to track the status of service requests. Some tenants would

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prefer to check status at a web site, while others would like to receive email. Some tenants want to be able to check indoor temperatures from a browser, and some tenants would like to be able to access maintenance notices from a browser or by email.

4. Tenants sometimes submit more than one service request for the same problem because they cannot track the status of their service requests and because they think it will reduce the response time.
5. Two of the tenants surveyed said they would use a web-based service request form.
6. One of the tenants said that they would be more likely to report problems if it were easier to report them.

Maintenance personnel told us that it is common for maintenance or construction activities to produce many redundant service requests.

From results in [3,4], and GSA maintenance databases we learned the following:

1. Temperature complaints are the most common service request.
2. In well-controlled buildings, half of the temperature complaints occur when the temperature is within the bounds specified in [5].
3. Data quality in maintenance databases is poor. Most of the fields are populated by hand.

Based on these findings, we included four key features in TIEMS. The first is the ability to check the status of service requests. User's can check the status of all service request they submitted and filter the display by status condition.

The second feature checks for service requests submitted from the same location during the past two hours. The design intent is to eliminate redundant service requests. TIEMS lets the tenant decide whether or not it is redundant.

The third feature of TIEMS is a list of notices that the maintenance personnel feel will convey useful information to the tenants. Tenants only see notices that apply to their location. Maintenance personnel can specify the length of time that the notices run.

The fourth key feature of TIEMS is the ability to check indoor temperatures. TIEMS displays the most recent temperature value from the GEMNet database corresponding to the location specified by the user.

Figure 1 shows results of a three-month field trial. The figure shows the number of service requests reported by three lead users per month. No data were available before February 2002. The figure demonstrates that users will use TIEMS for a significant fraction of service requests, eliminating the labor required to answer phone requests. Whether or not TIEMS affects the number of service requests is inconclusive. One of the lead users said "I love the system".

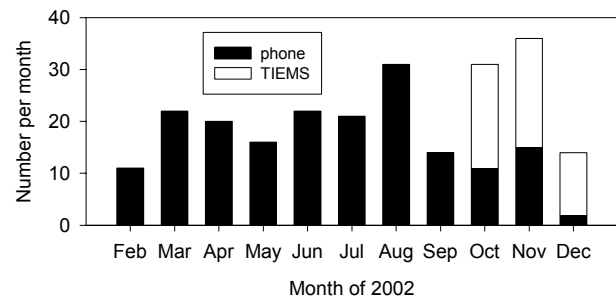


Figure 1: Results of TIEMS field trial.

DISCUSSION AND CONCLUSIONS

We expect the following benefits from TIEMS:

1. Reduced labor required for handling service requests
2. Better energy management resulting from better temperature control
3. Improved occupant satisfaction with maintenance services

The field trial demonstrated that TIEMS can reduce the labor required to answer phone requests, and that it increases occupant satisfaction with maintenance performance. The temperature checking feature of TIEMS should make it easy to identify whether or not a temperature problem is because of equipment failure or disagreement with temperature-related energy management practices.

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